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RUBBER.

Except in the case of Ramie, no cultivation has been so long practically neglected, and all at once sprung into notice as that of rubber within the past few years. Though rubber was first found in South America in the second voyage of COLUMBUS, it was not recognized as of any value till Dr. PRIESTLY, in 1770, pointed out that it was useful for erasing pencil-marks, and it was sold in cubes of half an inch for three shillings. The rubber industry really commenced about the beginning of the present century, and in 1830, 464 cwts. were imported into Europe, since then there has been a rapid rise to 948,404 lbs., valued at over £51,000.

It has long been pointed out that rubber cultivation was well worthy of the notice of planters, but in no part of the world does any great interest seem to have been taken in it except in Ceylon, where, from 1873, when seeds were introduced from Kew till 1886, when the cultivation was abandoned, the planters were very enthusiastic about it. The plants then under cultivation were Ceara and Para rubber. In Assam also, the Indian Government protected and formed plantations of India rubber (*Ficus elastica*). But the greater part at least of the rubber of commerce has always been derived from wild trees or vines, and as these were largely worked out from careless cutting, the supply decreased in quantity and increased in price. Later the African rubbers came into notice, and the market became overstocked. Following on that, however, came an enormously increased demand for rubber, partly due to the great development of the bicycle trade, and the increasing use of rubber tyres for carriages. To meet this demand now, we have Africa only as a large source of supply, for it is stated that the South American supplies, from want of a policy of consideration of the trees producing rubber, has fallen to such an extent that they can only meet a small part of the demand.

The African supply, though without doubt very large, is at present derived from wild plants of *Landolphia*, a climber, and *Kickxia africana* and *Ficus Vogelii*, trees, and the large amount now produced must diminish as the forests are ransacked wherever accessible. Meanwhile there is but little doubt that the demand will increase yet more, and in the future the demand will have to be supplied from cultivated trees.

KINDS OF RUBBER.

The number of rubber-producing trees and shrubs throughout the world is very large, and they may be divided for economic purposes into trees and climbers. Of the latter, the chief are the Landolphias of Africa and Madagascar, and the Willughbeias, Melodinus, Leuconotis, and Urceolas known here as *Getah Grip*

of the Malay Peninsula and islands. These climbers produce considerable quantities of the rubber of commerce, but are not at all satisfactory to cultivate. They grow, it is true, easily enough from seed or cuttings, but produce under cultivation thin, slender stems not at all easy to get the rubber out of, and even if they did attain the thickness of stem that they do in the jungle, which is about as thick as the leg, they would be difficult to work economically.

For cultivation purposes, it is, therefore, necessary to turn the attention to the trees, and of these the following are the kinds which have attracted most notice :—

India rubber,	*Ficus elastica*,	Assam to Perak.
Lagos rubber,	*Ficus Vogelii*,	West Africa.
,,	*Kickxia africana*,	,,
Jelutong,	*Dyera costulata*,	Malay Peninsula.
Pulei,	*Alstonia scholaris*.	
Ceara scrap rubber,	*Manihot Glaziovii*,	Brazil.
Para rubber,	*Hevea braziliensis*	,,
Central America,	*Castilloa elastica*.	
Mangabeira,	*Hancornia speciosa*,	Pernambuco.

Ficus elastica supplies a very fair rubber, but the tree seems to be of slow growth, and rather expensive to cultivate even in Assam. It does not grow at all well in Singapore, though it perhaps might do better in the hills of Perak and Selangor, but I should very much doubt its being at all suitable for cultivation by planters.

Ficus Vogelii and *Kickxia africana* are but little known as yet in cultivation. Seeds of the latter were received recently at the Gardens, but only a few germinated, and all soon perished.

Dyera costulata is a large tree common in our jungles. The rubber is abundant, but usually contains much water. It is considered of a low quality and seems chiefly to be used for adulterating other kinds. There is, however, a fairly large trade in it in Singapore.

Alstonia scholaris is also a common large tree, but the rubber is thought but little of and is seldom collected even in the Malay Peninsula.

Central American rubber, *Castilloa elastica*, the biggest of all the rubber trees, is a native of Panama, where it grows in damp wooded ravines, along the edges of streams. It grows very feebly here, and never looks healthy. It seems to thrive better in Southern India, but there is as much difficulty in extracting the rubber as there is in Ceara scrap.

Mangabeira, *Hancornia speciosa*, is a small birch-like tree, which grows on the dry sandy heaths in Pernambuco, where I have seen it. It is a poor class rubber, and is, I think, not worth cultivation, here at least. I doubt if it has ever been introduced into this country.

Para rubber, *Hevea braziliensis*, on the other hand, has the advantages of being exceedingly easily grown, and a very suitable

plant for wet low ground, for which we have no use except for sago or rice, and of which class of land there is a very considerable amount in the Peninsula. It also gives a quick return, at a very trivial cost, and requires no expensive machinery or elaborate cultivation, and finally holds, as it has always done, the first rank in value among the rubbers.

It has been tried in Ceylon and India, but I can find but little published as to its cultivation in the former country. It seemed, under Dr. TRIMENS' management, to have done almost if not quite as well in Ceylon as it does here, but, in spite of his recommendations, the planters seem to have condemned it with Ceara rubber, and abandoned it. In Tenasserim it seems to have done well, but I know nothing as to practical cultivation there on a large scale.

Manihot Glaziovii, Ceara scrap rubber, has attracted a great deal of attention in past years, and many trees were planted in Ceylon and elsewhere. The amount of rubber produced under cultivation was so small, and the profit so slight that the Ceylon planters destroyed their trees and abandoned the cultivation. In the Peninsula, trees were planted in many places, and though isolated trees are to be found as fine as could be wished, the greater part utterly failed. The failure in Ceylon gave the whole of rubber cultivation a bad name, because planters, describing their want of success, did not say, in many cases, what rubber they had been growing, and sometimes confused the two plants.

The Ceara rubber is easily known by its silvery bark, like that of a birch, while Para rubber has a brown rough bark. There is a great difference also in habit, the former tree having a straight stem with leafy branches only at the top, giving it a flat umbrella-like appearance, the latter having a tendency to branch at about six or ten feet from the base, and forming a magnificent large crown of foliage. The habitat of Ceara rubber trees is one of the driest of the Brazilian provinces, where the soil is sandy or gravelly or even rocky, where even tapioca requires to be watered, and there are occasionally years when no rain falls. In fact, the tree is a regular desert plant. What wonder then that it should not be successful in a wet climate like ours ?

PARA RUBBER.

Hevea braziliensis (*Euphorbiaceæ*), a very large tree inhabiting the swampy islands and banks of the river Amazon.—In suitable soil it grows very fast and attains the height of about sixty feet, with a diameter of about two feet through the stem.

The leaves are trifid, dull green above and whitish beneath. The flowers are produced in panicles on the ends of the branches. They are small and green, very sweetly scented, so that when a tree is in flower, it can be detected by the scent of the blossoms. The flowers seem only to be produced when

the tree has attained a considerable size, and usually before flowering the tree sheds a proportion of its leaves, sometimes becoming quite bare during the flowering season. The trees here flower somewhat irregularly. The fruit is produced some months later. It consists of a large three-lobed capsule about an inch and-a-half long containing a single large seed in each lobe. When ripe the capsule splits explosively, throwing the seeds thirty or forty yards from the tree.

This usually takes place in the hotter part of the day. The seed is about an inch long, rounded on the back and flattened in front, silvery marbled with brown in colour, much resembling a castor-oil bean on a large scale. They are very light and float readily in water. They germinate usually very soon after planting, and do not require to be filed or otherwise treated as Ceara rubber seed usually does, but do not retain their germinating powers very long, and should be planted soon after they are ripe.

Cultivation.—Para rubber can be raised from seed or cuttings. The former is the most to be preferred. The seed is planted in nurseries and lightly covered with soil, and when about six inches high can be planted out.

Cuttings are recommended for use in inundated spots where the seed might float away. They are taken from lateral twigs and planted in the mud so that their tops are above water, but they can also be grown in drier spots shaded at first from the sun.

They should be made from well grown wood, and not from the softer tops of the branches. It is sometimes stated that trees from cuttings do not last, and perish in a few years. Fallen trees, however, throw up strong stems, which eventually develop into healthy large trees, and, as it is stated that in South America trees are habitually grown from cuttings, there seems no reason why they should not be successful here.

The soil most suited for the plant is rich and very wet, such land as is commonly used for sago is very suitable, and wet rice-fields or any damp low-lying ground will do. The tree will grow on drier soil, but more slowly and in a less satisfactory manner. Where the ground is liable to shift from underground currents or streams cutting the soil away, the trees, owing to their having no tap root, are rather liable to fall, and though they continue to grow even when prostrate, they are much more difficult to tap. However, they are very easy to raise again wi h the aid of ropes, and can even when pretty large be propped up again, when they will continue to grow as before.

The trees can be planted about twelve feet apart or even closer. They grow very straight and do not spread much unless planted far apart, and the closer they are planted the straighter and taller they grow. When planted they require no further care than to keep down the brushwood and grass for the first year or two, after which they will draw up above

the weeds, and if planted close together will soon so shade the ground that but few weeds will appear beneath them. As they are rather sensitive to fire, care should be taken to keep down the lalang, if any should grow near the trees, to prevent risk of its taking fire.

In suitable soil the trees grow very fast. Trees planted from seed in the Botanic Gardens in 1888 have attained the height of about sixty feet and a diameter of from a foot to a foot and-a-half at the base. Some other trees, thirteen years old, planted about twenty feet apart have a diameter of about two feet, but are no taller. In these the stem has branched at about six feet from the ground which the closer planting of the others has prevented.

Trees on the outside of the wood which obtain more air and light are indisputably finer than those grown very close together, but it will probably be found better to grow the plants fairly close in order to obtain a taller and straighter stem which is easier to tap and to obtain a larger amount of stems on a given area.

I have not noticed any enemy, animal or vegetable, attacking the tree.

Collecting the rubber.—Trees can be tapped at the age of three years if they are well grown, but it probably would be better to wait till they are five years old, when they are stronger, and the wounds would heal more readily. It appears from the account of Mr. Cross, who went to Para to investigate the methods of collecting the rubber and the habit of the tree, that it was the custom of the collectors there to tap the trees in the early morning, but here it appears to be best to tap in the evening after four o'clock, as the milk is thicker and more free from water in the evening. I have noticed the same thing in other lactiferous trees, such as the Upas (*Antiaris*). It is preferable to tap in dry weather, not only on account of the greater amount of water in the milk in wet weather, but also because it is easier to prevent the rubber being spoilt by rain falling into the cups.

The tapping is best done in the following way. A number of oblique cuts are made in the bark converging to a central vertical cut, at the bottom of which a cup is placed. The rubber runs down the cuts into the central one which conducts it to the cup.

The cuts should be made through the bark, which is about a quarter of an inch thick, but so as not to injure the wood, and should not be made more than a half an inch wide. Their length, six or more inches, will depend on the thickness of the tree. These cuts may be re-opened a day or so later and more rubber will come out. It is best to make a small groove at first, cutting a thin slice off the edge of the wound each day till the groove is about half an inch wide. The wounds heal up in a few weeks if not too wide.

Any sharp knife can be used to cut the bark, but it will probably be necessary to supply the coolies with guarded knives which cannot be forced into the wood and so damage the tree. I have found a sharp chisel used with a hammer a good instrument for making the cuts.

The common method in Para seems to be to chop at the bark with a small axe with a blade an inch in length, and to put a cup under each incision. But this is a cumbrous and wasteful method and is not at all to be recommended. Another plan recommended by some is to make punctures in the tree and put cups to each puncture, but the method above described has the advantage of collecting all the rubber into one cup, instead of having a lot of cups on the tree, saving time and labour. In South America, cups of clay are prepared and stuck to the tree by means of lumps of wet clay, a very clumsy method, which also has this disadvantage, that the cups being quite open at the top, dirt and rain fall in and spoil the rubber. The best cups I have used are small cigarette tins with lids. These are nailed on to the base of the vertical cut with a small nail, hinge outermost. The lid is then pushed down so as to admit the rubber only. Any bits of stick, moss or dirt and rain will fall on the lid and not into the cup.

The cuts having been made and the cups fixed in the evening, the rubber continues for some time to run into the cup, and in the morning is found to have partially or quite set, and in a few hours a solid cake of pure white rubber can be taken out of the cup. Little or no rubber flows during the day.

There is usually a good deal of water which exudes from the rubber as it sets and after for a few days. This should be dried off in the sun, or the rubber can be pressed to get it out. The rubber shortly after it sets has a very foul smell, which soon goes off. In a few days the rubber becomes yellow, then dark grey. In Para it seems that the rubber does not set without being smoked in the smoke of burnt nuts. The milk is taken up on a batlet, and turned over and over in the smoke till it is dry, and then peeled off. This does not seem at all necessary here, unless it were necessary for improving the keeping power of the rubber. A sample cake of rubber prepared in the Botanic Gardens in 1893, on being cut across in 1897, was found to be perfectly sound and elastic and the interior even retained the white colour of the fresh rubber. This had been simply prepared in the above mentioned way without the addition of smoking or any other process.

Trees, if carefully cut, recover from their wounds very soon, and in a year or two can be cut again in the same place.

Amount of rubber produced by a tree.—The exact amount of rubber which can safely be drawn from a tree is not yet settled experimentally, but two pounds may be safely reckoned on for a year's tapping of a five or six years old tree if well grown, and it is probable that a larger quantity than this can be taken without harm. Of course much depends on the size of the tree, which

again depends on the soil and position in which it is grown. Further experiments are being made on this point.

A tree nine years old was tapped, April 20th. It was about forty feet tall and a foot through at the base. Cuts were made in it, the edges of which were sliced again every day for a week. The first cut yielded half a pound, and the whole result gave one pound fourteen ounces. Now (June 17), the wounds are partly callused over and the callus already contains rubber.

Price.—Para rubber seems always to command the highest price of any rubber in the market, fetching from half a crown to three and sevenpence a pound under ordinary circumstances. Samples sent from the trees in the Botanic Gardens to a well-known firm of rubber dealers were valued at the highest price then given for rubber. But, with the increased demand and failing supply, even higher prices may be obtained.

When one considers the little expense of planting, tapping and preparing the rubber, it seems clear that, though the amount given by each tree is not large, there should be a large profit made on the cultivation. One may safely say that the cultivation of rubber is at present in its infancy and may reckon that, as its study progresses, we shall obtain much larger results than these, which, I think, I have estimated at a considerably lower valuation than they will be found to bear.

RAMIE.

There is so much interest taken now in ramie that some notes on it may be acceptable to cultivators. The demand for the plant, which has been long neglected here, has been so great lately that it has been very difficult to provide an adequate supply, and ramie promises to be one of the most important cultures in the near future. Hitherto, the difficulty has been to extract the fibre in a satisfactory state, that is to say, clean and strong and economically. Numbers of machines and processes have been invented, and most of these have been but partial successes at most. Lately inventors have again turned their attention to the plant and with, it is alleged, perfect success. But while for some time the interest in the plant had died down, the fibre was still to be found in the market in considerable quantity, and has for a long time now been extensively used in making fabric, adulterating silk, rope-making, and in various ways. Most of this fibre has hitherto come from China, where it appears to be extensively grown, and where one variety is probably native.

There are two forms, or varieties, of ramie, viz., *Bœhmeria nivea*, Hook. & Arn., Ramie proper, or China grass, and the variety *tenacissima*, commonly known as Rhea grass.

The former is a shrub attaining sometimes the height of eight feet, but usually smaller. It has the appearance of a nettle, to which plant it is allied, belonging as it does to the same order, viz., *Urticaceæ*. The leaves are ovate and notched round the edge on fairly long leaf stalks, green above but white beneath. The flowers are very small and borne on long hanging racemes

from the axils of the leaves. They resemble those of an English nettle and are greenish white. The stems of the plant are woody, about as thick as a pencil and when full grown are reddish brown in colour.

The variety *tenacissima* is distinguished by its leaves being greener, sometimes quite green on the backs, and though there are forms of it in which the backs are whitish, they have not the conspicuous white colour of the real China grass. The home of this variety is not clearly known, but it occurs either wild or as an escape from cultivation in Assam, Burma, Bengal and Sumatra, whence I have recently received plants. It is generally said that the white-leaved ramie grows in temperate or subtemperate regions, and the green-leaved rhea in hot climates. The former has been grown successfully at Kew, out of doors, but the latter has failed. Both kinds are in cultivation in the Botanic Gardens in Singapore, and both grow exceedingly readily, the rhea, however, does seem to grow a little faster. At the same time, as Indian rhea is stated to fetch always a lower price than China grass, and the latter grows quite rapidly enough for all practical purposes here, it would be most desirable to grow ramie in preference to rhea.

Cultivation.—The plant is always grown from cuttings, unless it is for any reason absolutely essential to use seed. But raising from seed is easy enough though slow, although as the stems are or should be cut before the plant flowers in a plantation, it would be difficult to procure ripe seed. Almost any bit of the stem if sufficiently woody will grow, but it is best to make rooted cuttings from the base of the plant. The stems under ground push out stolons in all directions which are in old clumps often tuberous, and portions of these speedily emit branches, when cut and planted. Cuttings should be shaded at first till they are well established.

Soil and climate.—Very nearly any soil will do for ramie, except very stiff clay, or very wet soil. Flooding quickly kills it. Partial shade suits it well, but it will grow exposed to full sun. It suffers somewhat from draught, but plants growing in the full sun, in very poor soil in the Botanic Gardens not only survived the very hot and dry weather in the early part of the year, but grew steadily though slowly.

The climate of the Malay Peninsula is very well suited for ramie, because of the constant rain and absence of a dry season. A constant change from very hot and dry to heavy rain not only does not suit the plant but spoils the fibre, which grows irregularly unless there are no great variations of climate.

Manure.—The plant is certainly much improved by manuring, wood ash and cowdung seem to suit it best. These can be dug into the ground when it is first prepared for planting and later again when the plants having overcrowded themselves have to be dug up and separated.

Growth.—The rapidity with which the plants produce stems depends mainly on the size of the clumps. Rooted cuttings, or

tubers throw up shoots much faster than stem-cuttings. The stems themselves grow very rapidly and attain a height under certain circumstances of about eight feet, but they are best cut when about four feet high. When fit to cut the bark should be brown and the stems quite firm. When over four feet tall the fibre appears to be inferior and to deteriorate with growth.

Enemies.—The only enemy I have seen is a small moth-caterpillar which rolls the leaf up and eats it. It does not appear to injure the plant much, unless it occurs in great quantities, but it spoils the appearance of the plant, and may weaken it by retarding the growth of the stem. It seems to be most abundant in damp grounds. The caterpillar is about an inch long, of a dirty green colour with a black head, and is sprinkled over with scanty hairs. It turns into a chrysalis in the rolled up leaf, and in a few days comes out into a small grey moth belonging to the group *Pyralidæ*. It is one inch wide across the wings, which are grey with yellowish and iridescent reflexions with obscure darker grey spots in three transverse wavy bands. The margins of the wings are fringed and grey. The antennæ are long and slender yellowish brown, the eyes black, the legs long with white coxæ, the rest of the legs ocreous yellowish. The body is white below but coloured like the wings above.

The caterpillars can be removed by hand if they are found to be injurious or too abundant.

Extraction and treatment of the fibre.—A very large number of machines and processes for extracting the fibre of ramie have been invented, and fresh ones constantly under trial. Some recent inventions have been stated to be perfectly successful in every way, but not having seen them actually in work, it is impossible to give any opinion as to their value. The Faure machine seems to be the most popular one at the present time.

In one form of ramie grown in sandy loose soil in Penang it was found that the stems were soft and hollow instead of woody and solid, and that by beating them with wooden mallet on a board, the woody fibre could be broken up so as to be easily washed out. Not only was this a very simple process, but more fibre was obtained than by stripping the bark and washing it out as a considerable amount of fibre remained on the sticks after stripping, which could not be got off. Most ramie sticks are too hard for this treatment, and it remains to be seen whether this softer hollow stemmed form would not be more valuable to cultivate than the hard form. It may, however, be merely a form due to its cultivation in poor soil, in which case it would probably, on treatment with manure, or planting on richer soil, develop into the stronger woody form.

Uses.—The fibre of ramie may be said the best fibre known for general purposes. In strength it is as strong, and in some trials has proved stronger, than Russian hemp. It presents an unusual resistance to the effects of moisture, and is finer than flax. A small admixture of it improves paper, but it is at pre-

sent too valuable and expensive for use in this way, though waste bits might be disposed of to the paper-manufacturers with profit.

The fibre has long been used for nets and cordage, as well as for sail-cloth, the sails of several of the well-known racing yachts being made of it. It is also used for lighter fabrics, such as silk scarves, dresses, umbrellas, table cloths, lace, etc. From the various uses to which it can be put, it will be readily understood that the demand is practically unlimited, but it is necessary that the fibre should be produced clean at moderate prices, that is to say, about £30 per ton. If this can be done, and there seems no reason why it should not, ramie should ere long be extensively cultivated and exported from this region.

The waste leaves of the plant form an excellent fodder for cattle, which are very fond of it. The Chinese also, by boiling them, prepare a black jelly, of which there is a considrable sale in Singapore and elsewhere.

NOTES ON SUGAR CULTIVATION.

The sugar-cane is cultivated largely in many parts of the Peninsula, for native consumption almost everywhere, and for the manufacture of sugar and rum in Province Wellesley and Perak, and though the sugar trade of the New World is now almost at a standstill, that of the Malay Peninsula seems to be still thoroughly remunerative. Its market is the Eastern region, viz., China and Japan, which are not affected by the beet sugar trade which has done so much to injure the trade of Europe. The depreciation of silver has also done much to assist the trade in this region. At the same time, n view of the collapse of the Western sugar trade, it is important to note any disease or pests attacking the sugar-cane which appear here, and to suggest any methods of eradicating them before they attain proportions too great to be easily dealt with.

Few cultivated plants have as extensive a literature as sugar. Its cultivation and manufacture have been written about most exhaustively, and there are plenty of well-known books on the subject, but till lately comparatively little has been written about its diseases and the insect pests to which it is liable.

As too often happens with crops, so long as the cultivator is making a reasonable profit on the estate, he is apt to overlook any diseases which may occur, but when the times are hard and the pests become an important factor in the depression, he endeavours, sometimes in vain, to defeat an enemy which has gained strength by his neglect.

It must be always remembered, especially in tropical countries, that plants do not naturally grow in such large quantities together as is necessary for cultivation, and that this aggregation of plants of one kind renders them far more liable to disease than if they were grown in a more isolated manner.

Sugar again is exceptionally grown in this way. The fields are necessarily of very large size on flat low ground usually with hardly a tree in sight which may give a resting place to the birds,

which materially aid in the destruction of injurious insects, or which may prevent the wind from sweeping across the fields and strewing them with spores of injurious fungi.

Another peculiarity of sugar cultivation is the great length of time for which the fields are kept continuously under the same crops. Rotation of crops of any kind is hardly known in this country. As a rule, any crop is continuously grown on the same soil till it absolutely fails to be remunerative, either from the ground getting quite exhausted, or from over-supply ceasing to bring a profit, and when it is considered that here we have no frosts to disintegrate the soil, and no winters to compulsorily rest it, few earthworms to turn it over, and no ploughs or deep digging machinery so that the ground gets barely any rest from incessant cropping, it seems wonderful in many cases that we get the crops that we do.

Constant cultivation on the same ground for a long period of years—as much as twenty in many cases—might certainly be stopped by throwing out a field at regular intervals, each field being thrown out after a definite period, say, six or seven years, and fallowed for a year. The objection to this is that a field when left is liable to become full of lalang grass or a creeping grass called *Panicum distachyum* which are both very difficult to eradicate. Beans, or pea-nuts, *Arachis hypogœa*—may be used as a catch crop, and if looked after should soon cover the ground so that these grasses would not come up, and would of course be dug in eventually to manure the soil. The loss of the crop for the year would probably be repaid by the superior out-turn of the sugar for the next few years, and there is sufficient demand for pea-nuts to make it worth while to collect the fruit of the plant.

Deep ploughing by machinery could easily be effected in the cane fields, which are almost invariably flat, and could be readily worked.

The planting of trees near the estates might well be encouraged. There would be no harm at least in planting roadside trees along the paths and roads throughout the estate, while fruit trees and other useful trees might well be planted in waste spots round the coolie-lines and the bungalows. As a rule, one seldom sees any useful birds except swallows and hawks in the sugar-estates, as there is really nowhere for them to roost still less nest in these open fields, and the smaller birds have but little chance of escape from the hawks if they do come. The amount of insect pests that some of the birds destroy is very large, and some encouragement might well be given them.

High class cultivation such as is practised in Europe and North America does not as yet exist in the tropics, though improvements are being steadily made in this direction, but the absence of farm machinery from the peninsula undoubtedly does strike those coming from lands where cultivation is carried on in a more elaborate style.

Yet another point is striking in sugar cultivation. It is one of the very few in which cultivation is carried on entirely as yet

from cuttings, though for the last few years a good deal of experiment has been made in raising sugar from seed with somewhat varied results. Here we have till lately not even attempted to raise cane from seed. Experiments, however, are now being made in this direction, an account of which will be published later.

It is true that some other plants have been in cultivation for many centuries which are propagated asexually only, and do not appear to have deteriorated in any way; as for instance the common red Hibiscus and Jerusalem artichokes. Still I cannot recall any other plant which has been so long and extensively planted on the same ground without any cross-breeding as the sugar-cane, and this practical inbreeding must weaken the strains. In these respects sugar certainly stands alone, and it remains to be seen whether planters can modify these peculiarities of cultivation without undergoing any even temporary diminution in out-turn.

Pests.

Among the enemies of the sugar-cane here the worst are the sugar-borer caterpillar, some beetles, rats and one or more kinds of fungus, and of these probably the most injurious in all the fields are the borer and the fungi.

The sugar-cane borer.—The borer is the caterpillar of a small moth known as *Chilo saccharalis*. It is small grub about an inch long when full grown, and white with black spots. The head is hard and red, the body rather slender, with scattered bristles. It attacks the cane by boring into it, and often destroys it by tunnelling through the terminal bud. Sometimes it burrows up the cane for a short way, comes out to the surface and tunnels in again. In this way it does less harm, but injures the cane not only by the actual boring but also by forming suitable entrances for the red smut fungus, which when once introduced seriously injures the whole cane. The caterpillar turns into a chrysalis in the cane and develops eventually into a small buff moth. This moth is about one inch across the wings, of a pale buff colour, the underwings a little paler, in the centre of the upper wings there is a distinct black spot. The body is fairly slender and fluffy, the legs long, the palpi prolonged into a beak. At rest the moth sits with the wings together forming a triangle in the usual method of the group commonly called snout moths. I found caterpillars in the sugar-canes in January and February, and took the moth at the same time at light and flying over grass at night. It probably has no particular season, but may be found in either state all through the year, as constantly happens with many of our insects. I could not find the moth at rest during the day, though I sought for it in piles of leaves, in the grass and among the sugar-cane. However, I have seen it flying before sundown in Singapore.

From careful examination, I am led to believe that the moth lays its eggs, which are deposited with a quantity of fluff round

them, between the leaf sheath of the cane and the cane itself. This being so, it would seem that the more carefully canes are trashed, *i.e.*, the dead leaves are pulled off, the less chance would there be of the moth's laying its eggs on the cane, and did it lay its eggs on the bare cane, they would be washed to the ground by the first shower. In confirmation of this, I would mention that in patches of cane grown for eating by natives, the chilo is comparatively rare, and these canes are much more carefully trashed than is usually done in a large sugar-estate.

In some plantations in the West Indies it has been found remunerative to send boys to cut out bored canes, and destroy the grub in that way, but this would be an expensive work on a large estate. The insect seems to be very widely distributed, probably travelling with sugar-cane as it is carried about from place to place by natives. It occurs in the West Indies, and is abundant in Province Wellesley and Singapore and probably elsewhere in the Peninsula.

The difficulty of dealing with the insect chiefly lies in the large areas of sugar under cultivation. To cut out bored canes might be practicable in some cases, but the best way of preventing the pest becoming unmanageable would be to pay greater attention to the trashing of the canes, and to destroy by burning as much as possible the dead or broken bits of canes and trashing in order to leave as few hiding places for the insect as possible.

The Sugar-weevil (*Sitophilus sculpturatus*, Schŏn).—In some canes I found the grubs and perfect insects of the weevil. They appeared only to occur in broken or injured canes, but there seems no reason to doubt that they would also attack healthy canes and might be productive of great mischief.

The grubs resemble those of most weevils, footless, cylindrical maggots, with a brown horny head. They were about a quarter of an inch in length. The beetle is little more than a quarter of an inch long, with a rather long curved beak. The head and beak are of a dark brown, the thorax is of the same colour and strongly pitted, there is a black line down the centre and one on each side. The wing-cases are dark blackish brown with four strong ridges on each. The under part of the body is grey, thickly dotted over with pits, and the legs are brown.

The Sugar Rhinoceros-Beetle (*Xylotrupes Gideon*).—This large beetle I found two or three times among the sugar-canes, and I was informed at Caledonia Estate, Province Wellesley, that it had been found inside a sugar-cane. It is about two inches long and of a dark brown colour. The head is armed with a strong horn a quarter of an inch long, which ends in a fork, the points of which are curved outwards and backwards. The thorax nearly two-thirds of an inch wide is rounded and in the centre projects into a short stout process, curved forwards. The wing-cases are broad, shield-shaped and blunt, each having a short boss near the tail end. The antennæ are clubbed as is usual in the section of beetles to which it belongs and the legs are long and powerful.

The animal makes a peculiar whistling or hissing sound when it is handled.

This beetle is an ally of the Rhinoceros-beetle (*Oryctes rhinoceros*) which is so injurious to coco-nut palms. The grub probably lives on decaying vegetable matter, either cowdung or rotten trashings and bits of cane, and if allowed to become numerous is quite capable of burrowing into canes or cutting them down.

*The brown Chafer** (*Lachnosternasp*).—Among the roots of a very sick clump of cane I found the grub and perfect insect of a medium sized brown chafer. The grub about an inch long had the usual appearance of cockchafer larvæ. It was white with a brown horny head, rather long fore legs and the body dilated at the tail. The beetle is less than an inch long with a small head, notched in front, short clubbed antennæ, a broad smooth thorax, oblong, smooth, finely dotted wing-cases with fine longitudinal lines, the legs long and hairy. The whole beetle is of a deep chocolate brown, perfectly smooth except the under parts which are covered with a soft down and the legs armed with hairs.

This chafer lies in the evening and comes to light. It is doubtless a root feeder and if abundant might do much damage, the grub eating the roots of the cane.

Mr. CURTIS sent me a number of the same beetle found attacking the roots of nutmegs in Penang, and I have seen it in Singapore.

The White Blight (*Coccus*).—Appears not unfrequently on canes between the sheath of the leaf and the cane, but only in cases where the plant was sickly. Constant trashing would prevent this insect from being very injurious, as it is soon washed off the bare stems by rain, and can only thrive where it is protected by the old leaf sheaths.

The Shot-borer (*Xyleborus perforans*).—A minute beetle which perforates the canes in every direction, riddling them, does not appear to have attacked the canes in the Straits Settlements. It has proved most destructive in the West Indies, and it is to be hoped that planters will watch for it and should it appear take steps to prevent its doing damage. It chiefly lives in old casks and such like half rotten wood, and its introduction in this way should be carefully avoided.

A small gnatlike bug (*Hemipteron*) was exceedingly abundant in the canes in Caledonia Estate, flying in clouds when the cane was being cut. It appeared to be quite harmless, perhaps deriving its nourishment from the leaves of the cane.

Rats seem to be most destructive in some fields, and the mongoose had been introduced to keep them down. The large hawks which were constantly to be seen flying over the fields in the evening, no doubt destroyed a good many, but when the cane is fully grown or nearly so, it is impossible for the hawks to catch them, as the canes protect them.

**Note.*—I am indebted to Mr. C. O. WATERHOUSE, of the Natural History Museum, for the identification of these beetles.

The Red Smut Fungus (*Trichosphœria sacchari*, Massee).—A good deal has been written about this deadly pest, chiefly in the Kew Bulletin, and Annals of Botany, VII, 515 (G. Massee), and also in Dutch papers by Went, &c.

The fungus is reported as very injurious in the West Indies and Java, and is also very plentiful in the Straits Settlements. The mycelium attacks the centre of the cane producing a conspicuous red colouring. At first the fibre bundles in the stem are coloured and appear as red streaks, then the surrounding tissue becomes red, and eventually the cane becomes thoroughly infected, and the centre becomes black and rotten. Not only does the cane in bad cases become quite spoiled, but even where the disease has not progressed far enough for this and the cane is only partly affected, the sugar is altered and there is a considerable loss. Eventually if left the fungus produces its fructification in the form of black raised dots on the rind of the cane, which when fully developed push out black sooty thread-like processes, consisting of the spores.

For some time it was thought that the fungus could only get an entrance into the cane through the boring made by the moth-borer (*Chilo*) or one of the other insects which burrow into it, but though it is very common to see an attack commencing in and round a burrow, experiments made at Kew showed that the fungus could attack the cane through the remains of dead leaf-bases and scars formed by broken branches and roots. In the great majority of cases I have seen the attack seemed to arise from the burrow of a borer.

As the fungus is at least very likely to attack canes when cut or wounded in any way, it is clear that trashing by the aid of a knife should on no account be permitted. Indeed on most estates this is strictly prohibited, but coolies will use a knife to save themselves trouble when they can and this should be carefully looked after.

The cuttings to be planted should be carefully looked over to see if all are sound and healthy. To plant infected cuttings not only spoils the crop, but may produce the infection of others. In many instances I have seen all the canes on a stool stunted and useless or thoroughly infected with disease. Very badly affected cuttings do not grow at all. Examination showed that the original cutting was quite eaten up with the fungus down to the very roots. I have also seen in some fields a large proportion of diseased cuttings put by for planting, none of which were fit for use. In cases where cuttings are taken from Chinese cultivators special care is required, as owing to the carelessness of Chinese planters, disease is, as a rule, much more prevalent than it is in fields under European management.

All diseased canes or parts of canes should be burnt or thrown into water, the former by preference. No pieces should be left on or near the fields. When left upon the ground as is often the case, the fungus very quickly develops spores which are drifted about over the field by the first puff of wind. Nowadays it is

customary in large estates to dip the cuttings before planting into a solution of carbolic acid in water in the proportion of one pint of carbolic acid to one hundred gallons of water (the Queensland solution). This is probably of considerable value in disinfecting the cuttings, but of course will not make cuttings thoroughly impregnated with the fungus healthy or fit to plant.

COFFEE DISEASES.

My attention has been called to two fungus diseases of the coffee which seem to do a considerable amount of damage. The first of these manifests itself first in a cracking of the bark on the branches, usually in the upper part, and descending from the twigs sooner or later makes its way to the base of the branch, which soon becomes black and dies. Careful examination shows at first small white specks scattered on the diseased portion, which seem to develop into leprous pink masses forming patches on the dying twigs. Examination with the microscope shows that these masses are the fruiting portion of a bark fungus pushed up through the cracked bark, and producing large number of minute spores. The fungus, Mr. MASSEE informs me, belongs to a new genus which he calls *Necator* (*i.e.*, the killer), the species being *N. discretus*. It is allied to the destructive *Nectrias* which are parasitic on many trees. It seems seldom, if ever, to destroy the whole coffee tree, but it certainly injures it considerably, and should be looked after.

All boughs affected should be cut off well below the already blackened part, and *rigorously burnt* to prevent the development and dispersal of the spores.

Another fungus disease attacks the base of the stem and roots, quickly causing the death of the tree. In this case it will be noticed that the chief symptom is the thickening of the bark on the larger roots and at the collar at the base of the tree. The bark becomes corky, and whitish and irregularly cracked, or scaly. A section under the microscope shews that the cambium layer, between the bark and the wood is black, and the mycelium of a fungus has crept through it and often has traversed a portion of the wood as well, marking its course by a black line. When the fungus has completely encircled the tree, it is of course quite killed. One of the remarkable points about this disease is that it occurs in patches in the coffee plantation, and does not seem to spread. All the trees in the patch may be killed, and young healthy trees planted there perish very soon. From this it appears clear that the fungus is in the ground, in the form of mycelium or as it is often called spawn. On a tree which had been destroyed by this fungus and then pulled up and thrown away I found a quantity of a species of Irpex, namely, *I. flavus*, fully developed at the base of the stem and at other points where traces of damage from the mycelium could be seen.

This fungus is a leathery white irregular mass of no great thickness firmly attached to the bark of the tree, covered on the

lower side with small sharp points of a canary yellow colour when fresh. This was I think the spore producing part of the fungus (*Hymenium*) and serves to identify the plant.

This fungus probably establishes itself in the ground from the fallen trees destroyed in clearing and left to decay. All coffee trees affected by it should be burnt, and lime should be dug plentifully into the ground where the coffee refuses to grow. In Europe where some of these fungi do much damage to trees, it is recommended to dig a trench a foot and-a-half deep round the affected spot and fill it with lime, to prevent the fungus from spreading, and then treat the area with lime.

Another pest which has recently appeared among the coffee is an insect identical with, or closely allied to, the "White Grub" of Ceylon. This is the larva of one of the cockchafers, and is a white caterpillar about two inches long and much resembling the grub of the coco-nut beetle, soft and dirty whitish in colour with a large brown head and powerful black jaws. The legs are very long. The body, especially the tail, is sprinkled with stiff hairs, and the end of the body is somewhat swollen as is usually the case in the grubs of Lamellicorn beetles, to which group this animal belongs. It is very active, digging its way through the soil with its powerful head and long legs. Mr. GREIG who sent living grubs from Klang in Selangor writes: "It begins by eating all the side feeding roots and finishing by eating the tap roots."

The grub closely resembles that of the beetle called by HALDANE the big Patana cockchafer (All about Grub, R. C. HALDANE, published by A. M. & J. FERGUSON, Colombo, 1881). Like most of the larger cockchafers it appears that these animals live chiefly in grassy places, such as are known as Patana in Ceylon. and apparently only attacks coffee secondarily, its natural food being grass root. Guinea-grass is said to attract them. In digging in the Patana they were found at depths of from two inches to two feet, the chrysalides being buried deeper. HALDANE states that the richer the soil in vegetable matter the more liable it is to be attacked, and light friable soil generally escapes from a bad attack, "Decaying timber seems to attract them." This may be so, but most coffee estates contain a great abundance of decaying timber and at present this is the first instance I have heard of the appearance of cockchafers in the coffee estates here. Perhaps the author is referring to one of the other beetles which he classes as grub, some of which probably do feed on rotten wood, as well as roots. So destructive a pest as this cockchafer should be attacked without delay, or it will certainly spread to other estates in the neighbourhood. It is especially against this class of pests that barriers of forest between estates and parts of estates are exceedingly valuable both by stopping or turning the beetles in their flight and preventing their flying from estate to estate, and by encouraging birds and other insect-eaters to take up their abode in the neighbourhood.

Among other animals HALDANE recommends highly the jungle-pig which he has seen grub a field of coffee most thoroughly.

The wild pig is certainly highly destructive to tapioca and other tuberous-rooted plants, but I never heard of its injuring coffee trees, and doubt that it would dig them up. If it confines its attention to the grubs in the estate it might well be encouraged. Birds of course will destroy large numbers of these and other insects, and as the cockchafers, like most of the heavy beetles, fly in the evening, our nocturnal birds will be our strongest allies.

No planter, it is to be hoped, will shoot the night-jar (Burong Tukang Kayu) *Caprimulgus Macrurus*, or the Tiptibau (*Lyncornis*), nor any of the owls, the small kinds of which are great insect-eaters.

The common night-jar seems to be absent often from the wooded districts at least for a great part of the year. This is doubtless due to its habit of nesting among bracken which is often wanting in the wooded districts. In forest districts the Tiptibau takes its place, but I doubt that it is as valuable, as it flies much higher and feeds on insects which fly high which beetles as a rule do not do.

BIRDS ESPECIALLY USEFUL IN DESTROYING INSECTS.

It may be useful to call attention to the commoner birds which are of great value in destroying insects and which should be carefully protected by planters.

The value of insectivorous birds cannot be too highly rated. Indeed, were it not for them the hordes of caterpillars, beetles, termites, and grasshoppers would be quite unmanageable. This being so, the insectivorous birds about a plantation should not be shot or molested, and trees should be planted, where necessary, for them to roost and nest in and shade themselves from the great heat of the middle of the day. Where there are no trees large enough for them, as is often the case in coffee and sugar plantations, one sees but few birds, and I have seen in such estates the coffee trees quite eaten up by the caterpillars of various moths especially that of the very destructive bee-hawk.

The eagles and hawks, except in the case of sugar estates where they destroy rats and mice, are likely to do more harm than good by destroying the insectivorous birds, but an exception must be made in the useful little falconet (*Microhierax fringillarius*), a very small hawk no bigger than a black and white robin. It is black and white and may often be seen sitting on the topmost twig of a dead bough, darting off from time to time on its insect prey. It destroys grasshoppers, butterflies and moths.

Of owls there are several kinds, from the large fishing owl (*Ketupa javanensis*) to the little scops owls. The larger kinds eat mice and fruit bats. The smaller ones beetles and moths. The night-jars, or goat-suckers, "Tiptibau" and the "Burong Tukang Kayu," are very valuable assistants, destroying large quantities of evening flying moths and beetles. The swallows eat small insects of various kinds especially winged white-ants.

Bee-eaters, "Berik-Berik" (*Merops philippinensis*), beautiful green and blue birds with pointed tails and long beaks, are great enemies to white-ants, grasshoppers and other insects. They fly in small flocks sitting from time to time on the ends of bamboos or long boughs whence they dart on passing insects. When jungle is being burnt they will often flock round to seize the grasshoppers driven out by the smoke. The racket-tailed Drongo, "Chechawi," a black bird well known for the curious racket-shaped tail-feathers which it wears in the breeding season, catches many insects, but as a rule does not go far from the woods except towards evening. The sun birds, often erroneously called humming birds (*Anthreptes* and *Arachnotheres*), usually feed on small insects and spiders, but I have seen one attacking one of the big brown crickets which are often so destructive to seedlings. The black and white robin or magpie robin (*Copsicus saularis*) destroys many insects and especially caterpillars. The white-headed bulbul, "Merebah" (*Pycnonotus analis*), is omnivorous, eating insects of all kinds, but also great quantities of small fruits, especially those of the cinnamon, of which they will very soon clear a tree. It may eat coffee-berries too, but of this I am not sure.

The myna (Tiong) *Eulabes* and the Java sparrow (which has been introduced into Singapore apparently under the impression that it would eat insects) are both exclusively fruit-eaters, as are the starlings, and so are rather injurious than useful. The shrikes, of which we have two or three kinds recognizable by their hooked beaks, are insect-eaters. The commonest is the small brown shrike (*Lanius cristatus*). which is not much bigger than a bulbul. It may often be seen sitting on telegraph wires or the tops of bushes looking out for its prey.

The woodpeckers always appear where there is dead timber standing. They destroy the grubs which live in the wood, chiefly those of Longicorn beetles, and as some of these are injurious to the timber of the buildings, while some of the other wood-borer injure living trees either as grubs or when developed into the perfect insect, the woodpeckers are to be encouraged. Quails though seed-eaters to a large extent also eat grasshoppers and other insects, and as they run about among the bushes or in the cane fields may clear off a great many insects concealed beneath the foliage. They do not eat berries so they are quite harmless in the coffee. Hornbills and pigeons being fruit-eaters, though the former eat also small animals such as lizards, and sometimes large insects, do more harm than good and may be excluded from the birds worthy of protection.—H. N. Ridley.

ON THE CULTIVATION OF POT PLANTS.

Although the cultivation of ornamental plants is of less importance to mankind than that of those used in food, medicine, or the arts, there is no branch of horticulture that appeals to a wider circle in all civilized communities, and it is not surprising

to find that in a climate like ours, and with the style of architecture adopted, no home is considered complete without plants of some sort in pots, both indoors and out.

For the present purpose, we may divide pot plants into two groups—those grown for their foliage, and those grown for their flowers. As a rule the former are much easier to grow than the latter and consequently in many gardens flowering plants are comparatively scarce. One important reason for this is that as a rule all pot plants are grown either under trees, on the verandah, or in a shed especially constructed for the purpose; but in each case the result is the same, an insufficiency of sun for most flowering plants. It may be taken as a general rule, to which there are, however, exceptions, that flowering plants require sun and foliage plant more or less shade.

To attain the highest possible point of cultivation, probably hardly any two kinds of plant require exactly the same treatment in every particular, but in this paper it is not intended to enter into the niceties of treatment required by individual plant, or even classes, but rather to give some information of an elementary nature for the benefit of those interested but whose experience is limited.

Let me say at starting that there is no more a royal road to success in plant growing than in anything else, and the main requirements are patience and perseverance. Any one who takes sufficient interest in the subject and the necessary trouble is pretty sure to succeed, not with every kind of plant attempted, but at least with a sufficient number to make gardening a real pleasure.

Preparation of Soil.

The composition and nature of the soil in which pot plants are grown is of great importance, and one over which we have more control than in the case of other important factors, such as rainfall and temperature, but the majority of amateur gardeners pay insufficient attention to it. Different kinds of plants require different soils and although we cannot obtain such things as good fibrous peat, turfy loam, silver sand, &c., as recommended in English gardening books, sufficiently good substitutes can be manufactured with a little trouble and forethought. Every one desirous of growing plants should always have on hand, more or less in accordance with the requirements of the garden, a supply of leaf-mould; the best soil obtainable in the neighbourhood, which we call loam; mortar-rubbish, and river sand.

The general practice in most gardens here is to carefully sweep up all leaves as they fall and as carefully burn them. A great mistake. All leaves collected should be thrown to a heap by themselves as far removed from the roots of trees as possible, or better still in a brick pit, and there left to decay, turning them over occasionally to hasten the process. It is ready for use when it will pass freely through a one-inch sieve and the manure should be in an equally decayed state. Fresh manure should never be

used, and the leaf-mould should be entirely of rotten leaves without any admixture of grass or other rubbish. Now with these materials a mixture can be made to suit almost any of the plants (except Orchids) found in ordinary collections. The proportions will require to be varied for different plants, but a good mixture which may be termed the "stock" heap, and which will do well enough for a great number of things without any variation, is about equal parts of the leaf-mould, loam, and manure, with a sprinkling of sand, unless the loam is naturally sandy, in which case it may be omitted altogether. On the other hand, if the loam is stiff or clayey add a liberal quantity of sand. Also if the loam is naturally rich reduce the quantity of manure. Mix these well together by turning the heap over several times and it is ready for use. A good plan and one I always practise myself is to keep a heap of this "stock" on hand ready for use and to use it without any addition for ordinary purposes, but adding to it in the case of delicate plants, or where experience has shown the addition to be beneficial, more leaf-mould, loam, sand, charcoal, &c. Further instructions on this point will be given when we come to deal with a few of the more important classes of decorative plants.

Pots and Potting.

Pots that have already been used once should be washed inside and out and dried, before being used again. If this is not done there is often a difficulty in turning the plant out when it becomes necessary to transfer it to a larger pot without disturbing the roots as they will be found to have stuck to the sides.

A sufficient amount of drainage material should always be placed in the bottom of the pot to ensure the free escape of water. Pieces of broken pots are best, but broken bricks or tiles will do if these are not on hand. The largest pieces should be at the bottom and a concave piece directly over the whole to prevent its getting blocked up. Drainage is a most important matter, especially so in this country where the rains are at times exceptionally heavy and the native gardener without much judgment in the matter of watering.

The sizes of pots are reckoned in inches, the depth and breadth being approximately the same. A three-inch pot, which is about the smallest size ordinarily used, will require from half to three-quarters of an inch of drainage and a twelve-inch not less than two. In the case of delicate or valuable plants I should generally use more than this. On the top of the drainage material and before putting in any soil place a little rough peat, clean moss, or half decayed leaves, to prevent the finer soil getting down among the drainage and obstructing the free escape of water. Look carefully at the plant to be potted and choose a pot that is neither too big nor too small and in doing this be guided more by the roots than the leaves. Never put a plant with but few roots into a large pot as it is better to begin with a small one and transfer into a larger when that becomes moderately

full of roots. By this means a fresh supply of food is provided at a time when the plant is in a condition to make use of it. In transferring plants from smaller to larger pots an increase of about two inches at a time is generally sufficient. For instance a plant that has been growing in a four-inch pot can be put in a six-inch, and when that becomes full of roots into an eight-inch and so on. In the case of quick-growing hardy plants these measurements may be exceeded to save trouble in repotting so many times ; but if the plant is one it is desired to cultivate as well as possible repot as often as necessary. The soil at time of using should be neither too wet nor too dry, that is to say, it should be neither too sticky nor powdery. The latter condition can always be prevented by sprinkling it with a fine rose watering pot before using, but it sometimes happens that one is obliged to use soil wetter than is desirable and whenever that is the case let the plant stand a few hours, after being potted, without watering ; but if the soil is in a proper condition you can water immediately. In removing a plant from the pot in which it has been growing turn it upside down and knock it clean out without disturbing the roots. Place it in the centre of the newly prepared pot and fill the space between the ball and the side of the pot, pressing it gently but equally all round.

Watering.

The rainfall is not always what one could desire ; sometimes it comes too heavy, and sometimes, when most wanted, not at all. In the latter case the deficiency has to be made good with the watering-can, and I should think there is no question so often asked as the one "How often should I water this plant ?" It is a common saying among gardeners that the man who thoroughly understands the use of the watering-can has not much more to learn, and it is the want of this knowledge more than any other that makes the native *kebun* the vexation that he is. All plants even of the same kind, and standing side by side, do not require water in equal quantities or always at the same time, and no rule can be laid down as to how often any plant will require water. Much depends in the amount of root action going on, the state of the drainage, size of the pot, state of the weather, &c. Observe carefully and if the soil looks dry, water and water thoroughly until the water percolates through the bottom of the pot. Do not water again until the soil again shows signs of becoming dry. Avoid constantly giving a dribbling of water which moistens the surface only as the plant either wants water or it does not ; if the former then give enough to moisten the whole mass of the soil. With a little practice it is easy to tell whether a plant is dry or not by simply tapping the pot gently on the outside with the knuckles or a bit of stick. If dry it gives out a hollow sound easily recognized after a little practice. Morning and evening are the best times to apply water, but in very hot dry weather it is sometimes necessary to water in the middle of the day, or at least while the sun is still high, and whenever this is the case the foliage should not be made wet.

Sowing Seeds.

Raising plant from seeds is interesting and in the majority of cases by no means difficult. Owing to the uncertainty of heavy rainfall at almost any time of the year it is advisable to raise all seeds of a delicate nature under some sort of covering, as a single heavy shower will often destroy them. Shallow boxes, pots or pans may be used for this purpose, but whichever is used proper provision should be made for drainage as already directed for potting plant.

For sowing seed the "stock" soil may be used, but it must be passed through a quarter-inch sieve, and a small portion for covering the seeds through a still finer sieve. Add more leaf-mould and a liberal proportion of sand to prevent the soil binding. Directly on top of the drainage place an inch or more, according to the depth of the pots or boxes being used, of the refuse obtained in passing the soil through the sieve and on the top of this the finer soil until the box or pot is full to within a quarter of an inch of the top. Make the surface as smooth as possible, water gently but liberally with a fine rose pot and let it stand for an hour or two before sowing the seeds. By watering thoroughly before sowing the necessity of pouring much water on the seeds immediately after planting is prevented. The ordinary watering-can with a tin rose is ill adapted for seeds and a small one with a fine brass rose should be kept for this purpose. In sowing the seeds spread them evenly over the surface and cover with the finest soil mixed with one-fifth its bulk of sand.

As to the depth of covering to be placed on the top of the seeds that depends on the kind sown, but it may be taken as a safe rule that a covering equal to the diameter of the seed is sufficient. It will be seen from this that in the case of minute seeds, such as Begonias, Gloxinias, &c., the covering must be extremely light and in such cases a mere sprinkling of the finest sand is also sufficient. With such fine seeds it is advisable to place a piece of glass over the pot to prevent the soil drying too rapidly, and instead of watering to stand the pot in a bucket of water for a few minutes if necessary. The water in the bucket must not be sufficient to slip over the top of the pot. The period required for seeds to germinate varies considerably. Some annuals germinate in two or three days, while one of our local palms the "Bertam" takes a year, and there are seeds which take much longer than that, but these are extreme cases.

After sowing, water carefully with a fine rose watering-can and place in a cool place protected from the rain, but as soon as the plants appear above ground, remove them to a more open spot, continuing to protect from heavy rainfall until they have acquired strength to stand it. One of the commonest things that happens to seedlings, especially things that germinate quickly, is what is termed "damping," that is, the young plants die off close to the ground and if not attended to immediately the whole lot is often lost. This is generally caused by over-watering,

but sometimes by a superabundance of moisture in the air. It can sometimes be checked by removing carefully with a pointed stick all the diseased plants and sprinkling among the remainder a little charcoal or dry sand, at the same time lessening the supply of water, or removing the pot to a drier position, but the safest thing to do as soon as it commences is to prick them off at once into another pot using the same soil as advised for seeds.

Annuals.

Few plants grow so easily and quickly or make more show when in flowers than annuals, but much disappointment (and sometimes unnecessary expense) is experienced when unsuitable kinds of seeds are obtained as is often the case with beginners. None of the "collections" advertised by the seedsman either in India or England, and of which many residents here have had some experience, are quite what is wanted for this climate. They generally include Mignonette, Stocks, and a number of things that are useless here.

After having tried pretty well everything that is likely to succeed satisfactorily, I recommend the following as the easiest to grow, and the range of forms and colours is practically unlimited :—Balsams, Rose-flowered and Camellia-flowered ; Dianthus chinensis, in its various forms and colours, both single and double ; Coreopsis Drummondii, C. coronata, C. tinctoria ; Celosia, especially the feathered kinds ; Gaillardias, one of the best things possible for cutting ; Marigolds, French and African varieties ; Phlox Drummondii, in a great variety of colours and forms ; Sun-flowers, both the tall growing kind and the miniature ; Torenias, Zinnias, Petunias and Verbenas. The last two do not grow so easily as the others, except during the dry season when they do fairly well. All these may be grown either in pots or in beds, or both. Most of them may be had in flower during the whole year, but to keep up the standard, fresh seeds must be imported pretty often as they degenerate rapidly. Seeds keep very badly in this climate and should be sown as soon as possible after arrival unless, as should always be the case, they are in hermetically sealed tins when they should not be opened until required for sowing.

Although many may be sown at any time, November and December are the best months as they then come in flower during the months when there is least rain and consequently last much longer. The directions already given as regards preparation of soil, pot, sowing seeds, &c., are applicable generally to all these. The main point to be observed is to grow them in the full sun. From the hour they appear above ground plenty of sunlight is absolutely necessary. If kept in the shade for only a few days the plant becomes long and weak and practically spoilt.

There appears to be a pretty general idea among amateurs that plants belonging naturally to a colder climate should be placed under a tree or in some similar place because it is cooler, but

experience proves this to be wrong especially so in the case of annuals.

Cannas.

Among flowering plants suitable for either pots or beds there are few that grow so freely or flower so continuously as Cannas and no plant has been improved so rapidly under the hybridizer's hand. Every year brings out a new set an improvement in some one or more direction on their predecessors. A dwarf habit combined with large flowers are the two points that have been mainly aimed at and the result is marvellous. Until 1892 the only canna grown here was the one with small red flowers (Canna edulis), but in that year we introduced from England some of the best hybrids and have continued to add each year a few of the best new ones. Of the forty or fifty varieties introduced among the best are Koningen Charlotte, Madame Crozy, Comtesse d' Estol, Epi d'Or, Paul Bert, Mons. Corbin, Paul Liguist, Premises de Nice, Countess Elgin and George King. The two latter were raised in India and are equal to the best of those from Europe. Propagation is best effected by division of the roots as they cannot be relied on to come true from seeds. The main requirements for cultivation are plenty of manure, leaf-mould and water and the removal of the stems as soon as they have done flowering to make room for the young ones to come up in exactly the same manner as is done in bananas. As soon as the pots become crowded with roots divide them and plant afresh. They do best during the rainy season, when flowers are, as a rule, scarcer than at any other time, and are therefore invaluable. On Government Hill, where the temperature is lower than that of the plains, the colours become brighter but otherwise they do not do better in any way.

Bulbs, Tubers, &c.

Much of the difficulty, in fact in many cases the impossibility, of growing some plants is the want of a winter or resting season, but in the case of bulbous or tuberous roots, especially when grown in pots, this is not so great an obstacle, as the necessary rest can be obtained by withholding water and placing the pots in a position where they will not get the rain. Gloxinias, Achimines, Amaryllis, Hæmanthus, Arisæmas, Caladiums, Dahlias, &c., may all be treated in this manner. When they have completed their season's growth which is seen by the foliage beginning to get yellow and unsightly, place them where they do not get the rain, gradually reduce the amount of water and eventually stop it altogether. As soon as the foliage has quite died off, the root may be turned out, with all the soil knocked off, and stored in dry sand for three or four months. Examine them now and then to see whether they are beginning to grow, and if so it is best to pot them. In potting put a tablespoonful of dry sand directly under and around each bulb, which will prevent them from rotting, and do not water them for some days as the moisture in the soil and in the bulb is sufficient to give them a start.

As they grow and increase both in leaves and roots so increase the quantity of water. Although these kinds may all be treated the while same as resting they do not all require the same treatment when growing. Dahlias require the full sun, but Gloxinias require light shade and a dry position, otherwise the leaves damp off rapidly.

Caladiums.

Caladiums are fast coming into favour in Europe and the new hybrids are greatly in advance of the older varieties. For many years the improvement of these plants was left mainly to the French and Belgians, but during the last few years several English gardeners have taken them in hand and been working in the direction of a dwarfer and more compact habit. They are admirably adapted for cultivation in this climate and require no special attention.

More leaf-mould, sand. and some broken charcoal added to the "stock" suits them well. Moderate shade only is necessary, the mistake generally made is to shade them too much, in which case the leaf-stalks become drawn and the plant looks untidy, besides never acquiring the same bright colour. Among the best of those recently introduced are Mrs. Harry Veitch, Count de Germany, Ibis Rose, Ladas, Tennyson, John Lang, Assungay, Chelsea Gem, Lillie Buck.

Begonias.

Hardly any plants are generally more grown here than Begonias and especially those with ornamental leaves of the Rex type, but many growers find difficulty in preventing them from rotting off. This is generally caused by over-watering, and sometimes by unsuitable soil. A rather light soil with plenty of leaf-mould and a fair proportion of sand and charcoal suit most of them. A moderately dry spot with protection from the heavy rain is the most suitable place to grow them. The flowering kinds will bear more rain and sun than the fine foliage kinds. Tuberous Begonias which make such a grand show in summer in England are of no use here. I have succeeded two or three times in flowering these, but the result is not equal to the trouble.

Roses.

Although Roses are generally grown in pots they do better planted out in beds. Only a limited number of kinds grow satisfactorily in this climate and even these become exhausted in a comparatively short time. Chinas and Teas are the kinds most suitable to grow and they continue to flower all the year. Hybrid perpetuals are not satisfactory. For pot cultivation three parts of good stiff loam to one part of old cow manure and a little bone manure added will be found to answer.

Stand the pot on bricks or some other hard bottom in a fully exposed position.

Orchids.

There are so many kinds of orchids differing entirely in their habits, manner and seasons of growth, that to attempt to gene-

ralize on their treatment is a matter of some difficulty, for what is suitable for one kind is quite unsuitable for another. There is one point, however, in which they all agree, and that is in requiring plenty of water when growing freely, and little or none when they are resting. As in the case of bulbous and tuberous rooted plants much can be done towards inducing rest at will by withholding water at the proper time, and by this means often forcing the plant to flower. Dendrobiums, especially the Burmese and Indian species, require a long period of drought to flower freely. Under natural conditions they do not get a drop of water for four or five months, except what they receive in the form of dew, and it is during this period that most of them flower. During the growing season they receive abundance of moisture, and these conditions it is necessary to imitate as nearly as possible when under cultivation. Those from Borneo, Java, Sumatra, Philippines and the Malayan Peninsula do not, as a rule, experience such a long drought, and many kinds from these regions can hardly be said to have any decided resting season, consequently they should never be reduced to such a state of extreme dryness. Only a comparatively limited number of Orchids can be grown successfully in this climate, and even these, with a few exceptions, are better grown in England than here. Our choice is naturally limited to such kinds as will stand a high temperatre largely charged with moisture and with very little variation all the year through ; consequently only a few of the South American species, and scarcely any of the Asiatic ones from mountain ranges, are quite satisfactory. The wondrous range of forms and colour, together with the long period during which the greater number of the flowers last is, however, sufficient inducement for any one having a garden to try their hand at Orchids. Among those with good showy flowers, I have found to succeed best in Penang, are Vanda Sanderiana, Vanda tricolor, Renanthera Lowii, Cypripedium Lowii, Dendrobium Dearii, D. superbum, D. thyrsiflorum, D. densiflorum, D. Dalhousianum, D. Veitchii, D. Pierardii, D. Farmerii, Cœlogyne asperata, C. pandurata, C. Cumingii, Peristeria elata, Oncidium ampliatum, Cattleya gigas, Saccolabium guttatum, S. giganteum, Aerides virens, Calanthe Veitchii, C. vestita and C. veratrifolia. This list might easily be extended to a hundred or more species that do satisfactorily, but for the beginner this is a sufficiently extensive selection.

Orchids may be grown either in pots, baskets, or on blocks of wood. As a matter of convenience we grow the greater number in pots made specially for the purpose with greater facilities for the escape of the water than in the ordinary pot, but baskets or blocks of partially charred wood do equally well, and for some kinds are even better. The advantages of pots are that they are more durable, and it is easier to see the condition they are in as regards moisture quicker than can be done in baskets when hung above the level of the eye. Whether grown in pots or baskets great attention must be paid to drainage. The pots should be

filled to not less than two-thirds of its depth with clean broken bricks and lumps of fresh charcoal, the larger pieces at the bottom and smaller ones towards the top. Much soil is seldom necessary, and for many none whatever, broken bricks and charcoal in big lumps being sufficient. Moss and peat, out of which all the fine stuff has been sifted, in equal parts with a sprinkling of sand, is a suitable mixture for many Orchids, but a large body of soil is at no time desirable. For hanging baskets there is nothing better than teakwood, but as it is not always obtainable we here use Chengal which is durable and answers the purpose very well. The proper time for re-potting is just when the plants are commencing to make new growths. In some cases shoots and roots commence simultaneously, but in others the young shoot has made considerable progress before there is any sign of new roots, their nourishment in the meantime being derived from the amount stored up in the previous year's growth. It is difficult to persuade orchid growers in England that there can be any special care or attention necessary to grow Orchids in the regions to which they naturally belong, but as a matter of practice I find it more difficult than to do the same thing in a glass-house in England. Given a knowledge of the natural conditions under which a plant grows there can be, with the exception of sunlight, more closely imitated under glass than in any garden in the tropics. Under glass the two essentials—heat and moisture—are entirely under control, and the suppression of the insect pests comparatively easy.

Palms.

From a decorative point of view no plants are more worthy of attention than palms; they are easy to grow and will stand better in rooms than almost any other plant, while as regards effectiveness there can be no two opinions. Their one fault, if fault it can be called, in the eyes of some is that they are, especially in the earlier stages, slow growers. When thoroughly established with plenty of roots the "stock" soil will do for pretty nearly all palms, but for young plants add more leaf-mould and a little sand. Although many, in fact most of them, will, if gradually accustomed to it, stand the full sun, they are much better growers in moderate shade as they have then a more graceful habit and a darker green colour. When the pots have become quite full of roots they require plenty of water, and if this is attended to quite large plants may be kept in moderate sized pots for many years. If allowed to get excessively dry they soon begin to turn yellow and lose their lower leaves. In addition to the numerous kinds that have been introduced from various countries the jungles in this part of the world are full of interesting species well worth growing in any garden. Some of the rotans in a young state before they begin to climb make very handsome pot plants, but in collecting these or any other palm bear in mind that palms unless quite small transplant very badly. Personally I prefer to get seeds, but as they take some time to germinate many growers have not the necessary patience for this.

Livistona chinensis, L. australis, L. rotundifolia, Thrinax elegans and Pritchardia pacifica are good kinds with fan-shaped leaves and Ptychosperma McArthurii, Cocos plumosa, Oreodoxa regia, Martinezia caryotæfolia and Chrysalidocarpus lutescens are species with a different and more erect habit and are worthy of a place in every garden.

Ferns.

Ferns thrive admirably in this climate and are largely grown, but in the majority of cases the number of kinds is limited. Maiden-hairs (Adiantum) are the favourite class, and of these A. tenerum, A. colpodes, A. trapezi forme and A. Farleyense are the kinds most generally grown. Our local Ferns do not receive the attention they deserve for there are many beautiful and interesting kinds wild in the jungle and by the road-sides. For the majority of Ferns a moist shady place is suitable, but for gold and silver Ferns (Gymnograms) and some of the Adiantums a dry and shady place with protection from heavy rains suit them best. Plenty of leaf-mould and a little old lime-rubbish suits nearly all Adiantums, many of which are found naturally growing on lime-stone rocks. Brick-dust and broken charcoal is also beneficial for many Ferns.

Dracænas.

Dracænas are very effective pot plants and not difficult to grow, but it is only now and then one sees them in perfection, that is, well coloured and with leaves close down to the pot. As a rule there is a foot or two of stem without any leaves. This is easily remedied in the following manner. Remove with a sharp knife a few of the lower leaves, if they are at all bad, and quite close up to the good ones remove a ring of bark about one-eighth of an inch broad right around the stem. Take a good handful of coco-nut fibre and tie it firmly around the stem about two inches below the ring so that by drawing up the ends you can form a cup, into which put a handful or two of light sandy soil or leaf-mould so that it comes in direct contact with the part from which the bark has been removed ; then tie it firmly so that it cannot slip down and keep it moist until the new roots show themselves pushing through the ball of fibre when it can be cut off close below the ball and planted in another pot. This process may be repeated over and over again as often as the plant loses its lower leaves. It will perhaps be said why take all this trouble when by simply cutting off the top and planting it the same end can be arrived at ? It is true that Dracænas grow easily from cutting, but if the top is cut off without being first rooted in the manner just described it will again lose several leaves before it is rooted and be only a little better than the original. This plant is subject to a root disease similar if not identical with one that affects sugar-cane and I find that the addition of a little lime to the soil is beneficial. There are numerous named varieties in cultivation here, all of them good and effective when well grown.

Aroids.

This very large Order, and exclusive of Caladiums which have already been mentioned, includes a great number of very ornamental garden plants with bold, effective, often variegated, leaves, and in few cases striking flowers, though as a rule the flowers are inconspicuous. All the plants known locally as "kladi," and a good many others, belong to this Order. The most desirable genera for pot culture are Anthurium, Alocasia, Philodendron, Curmeria, Dieffenbachia, Phyllotænium, Aglaonema, and Arisæma, of which there are numerous species. Hardly any plants are more effective than Anthuriums, among which the best are A. Warocquenum, A. crystallinum, A. regale, A. Andreanum and A. Ferrierense. The first three are grown for their fine foliage and the others for their flowers, which are striking and last a long time in condition. Of Dieffenbachias there are many species, the best of which are D. Bausei, D. brasiliensis, D. eburnea and D. Jenmani. When these get tall and unsightly they should be "ringed" in the manner described for Dracænas. Arisæmas are mostly of botanical interest, but there is one, A. fimbriata, the Cobra-head worthy of a glance in any collection, and it is moreover a local plant. Aglaonema costatum is another local plant from Pulau Langkawi with mottled leaves and a pretty dwarf habit. Most of these Aroids have thick fleshy roots and require open free soil. Lumps of charcoal and chopped moss with plenty of leaf-mould suits them all. None of them require much sun, and when once fairly established they require plenty of water.

Plant Sheds.

A plant shed of some sort is to be found in most gardens of any size and although not absolutely necessary where there are trees or other suitable shady places for foliage plants, ferns, &c., is always, if properly managed, a pleasing addition. The cost of a suitable structure may be much or little according to the size and material used. Where expense is no particular object light T or angle iron is undoubtedly a much better material than wood, being neater and more durable, but so far as the cultivation of plants are concerned a few poles and chicks can be arranged so as to serve the purpose as well as the most expensive material. The two forms of sheds most general are the simple span roof and the octagonal and both are well adapted for the purpose. It is necessary whatever form the building may take, that some portion should be attapped in order that there may be a place in which to put such plants as will not stand heavy rain and this must be done with as little obstruction of light as possible and with the prevention of drip. This end is most easily obtained by attapping a width of two or three feet of the lower portion of the roof and covering the upper with chicks or split Nibong. Light and rain will thus be admitted from the centre, while the side beds will be protected from both rain and drip. Whenever practicable it should be quite close to the dwelling, and if possible

accessible directly from one of the principal rooms of the house. In the one or two cases in which this has been done the result has been most effective and the wonder is that the practice has not become more general.

Plant in Rooms.

Although some plants, especially palms, will continue to flourish for a long time indoors, it is advisable to change them pretty often, or if the circumstances do not admit of their being changed they should be put out at night and occasionally in a heavy shower to wash the dust off, and freshen them up. While in the rooms keep them in as light a place as possible for nothing weakens a plant so much as being kept in a dark place. See that they do not suffer from want of water, but at the same time do not over-water them. In the case of Orchids or other plants in flower do not wet the flowers as they will last much longer if kept dry.

General.

To carry out the few suggestions here offered, which only touch the fringe of the subject, no great expenditure of money is necessary, but in a country where everyone has to be his own head-gardener some little forethought and personal interest is absolutely necessary. As a rule there is no difficulty in obtaining manure, but it must be thought of and obtained long before it is actually required for use so that it may become thoroughly decayed. Leaf-mould is more difficult to get and takes a long time to make and a cart-load of fresh leaves amount to very little when decayed. Most of the principal roads in the Colony are planted with shade trees which though not truly deciduous shed large quantities of leaves during certain seasons which are swept up and burnt or carted away by Municipal coolies and would no doubt be given to any one in the neighbourhood who cared to collect them.

In addition to the few tools generally provided a fine rose can for watering seeds and a couple of rotan sieves are indispensable and also a brass syringe for watering Orchids on blocks and giving a general freshening overhead to the whole collection in very dry weather.

C. CURTIS.

Penang, 10*th September*, 1896.

A Select List of easily grown Plants suitable for cultivation in pots and baskets.

Name.	Native Country.	Remarks.
A.—Flowering Plants.		
Achimenes hybrids	South America ..	These require light shade and to be dried off after flowering.
Æschynanthus obconica ..	Perak ..	Flowers red; specially adapted for hanging baskets.
,, Lobbiana ..	Malaya ..	
Anthurium Andreanum ..	Columbia ..	The majority of Anthuriums are grown for foliage; these two have highly coloured spathes.
,, Ferrierense ..	Garden hybrid ..	
Arisæma fimbriata ..	Langkawi ..	Curious plant with a spathe resembling a cobra's hood.
Begonia	Various ..	Many shrubby Begonias do well, but none of the tuberous section.
Beloperone oblongata ..	Brazil ..	Flowers pink. Moderate shade.
Canna, Garden hybrids ..	South America ..	Colours various; suitable for either pots or beds. Grow in full sun.
Clerodendron nutans ..	India ..	Flowers white. Full sun.
Costus igneus	South America ..	Flowers orange. Requires shade.
Crinum amabile	Sumatra ..	These and many other Crinums (commonly called Lilies) are well worth cultivating.
,, Kirkii	Zanzibar ..	
Chrysanthemum	Japan ..	Grow in full sun.
Crossandra infundibuliformis ..	India ..	Flowers reddish orange and last long in water. Grow in full sun.
,, undulæfolia ..	Do. ..	

A SELECT LIST OF EASILY GROWN PLANTS SUITABLE FOR CULTIVATION IN POTS AND BASKETS—*Continued.*

Name.	Native Country.	Remarks.
Eucharis grandiflora ..	New Grenada ..	E. grandiflora, E. amazonica; commonly called Eucharis Lily and grown by everybody. The other two have white flowers, but differ somewhat in size and shape.
,, Lowii	Do. ..	
,, Sanderiana ..	Do. ..	
Eurycles amboinensis	Moluccas ..	A bulbous plant with large heads of white flowers; requires plenty of sun.
Gesnera exoniensis	Garden hybrid ..	There are numerous others. All require to be grown in a place protected from heavy rain, but with plenty of sunlight.
,, refulgens	Do. ..	
Gloxinia	Do. ..	Same treatment as Gesnera.
Hedychium coronarium ..	East Indies ..	Flowers white, sweet scented.
Hæmanthus Kalbreyerii ..	Guinea ..	Large umbels of crimson flowers; a very desirable plant.
Hippeastrum, hybrids ..	South America ..	Better known as Amaryllis; colours various; easy to grow.
Hoya imperialis	Malaya ..	Commonly called wax-flower. Suitable for hanging baskets.
,, multiflora	Do. ..	
Ipomea Horsfalliæ	West Indies ..	Lovely climbing plant with deep rich rose-coloured flowers.
Ixora macrothyrsa	South Sea Islands ..	There are a great many species and varieties of Ixora of many colours. They all require to be grown in sun.
,, sanguinea	Garden Variety ..	
Jasminum gracillimum ..	Borneo ..	Flowers white; full sun.
,, Sambac	India ..	

Impatiens platypetala ..	South Sea Islands ..	Soft fleshy plants requiring a moderate share of sun and care in watering.
,, sultanii	Zanzibar ..	
Medinilla Curtisii	Sumatra ..	Ornamental flowering shrubs. Moderate shade.
,, magnifica	Philippines ..	
Mussænda frondosa ..	T. Asia ..	Woody shrubs. The coloured floral leaves or bracts are the attraction in this plant. Grow in full sun.
,, luteola	T. Africa ..	
Plumbago capensis	Cape of Good Hope	Flower pale blue. All require rather sandy soil and plenty of sun.
,, rosea	East Indies ..	Flower rose.
,, zeylanica	Do. ..	Flower white.
Poinsettia pulcherrima ..	Mexico ..	Large vermilion bracts. Sun.
Posoqueria multiflora ..	Brazil ..	Shrub ; flowers white. Sun.
Ruellia rosea	Do. ..	Small, shrubby. Grow in sun.
Russelia juncea	Mexico ..	Graceful shrubby plants with red flowers. Plant in rather sandy soil.
,, rotundifolia ..	Do. ..	
Salvia splendens	Brazil ..	Flowers scarlet. Moderate shade.
Scutellaria Mociniana ..	Mexico ..	Flowers bright scarlet.
Solanum Wendlandii ..	Costa Rica ..	Flower lilac-blue. Climber.
Stephanotis floribunda ..	Madagascar ..	Grows best in full sun.

B.—Foliage Plants.

Acalypha Macafeeana ..	Fiji Islands ..	Shrubs with highly coloured leaves and equally useful for either pots or beds. Plenty of sun is necessary to bring out the colours.
,, macrophylla ..	Do. ..	
,, marginata ..	Do. ..	
,, musaica	Polynesia ..	
Aglaonema pictum	Borneo ..	Aroids with variegated leaves. Require moderate shade.
,, costatum ..	Langkawi ..	
,, commutatum ..	Philippines ..	

Name.	Native Country.	Remarks.
Alocasia cucullata	India ..	Alocasias are of a bold and striking habit; the veins of the leaves in A. Lowii var. grandis are white, A. Sanderiana has the leaves deeply lobed. A light rather sandy soil and moderate shade suits them best.
,, Lowii grandis ..	Perak ..	
,, metallica	Borneo ..	
,, Sanderiana ..	Philippines ..	
,, Sedenii	Garden hybrid ..	
Anthurium crystallinum ..	Columbia ..	Anthuriums are among the most beautiful of ornamental leaved plants and free growers. There are a great number of kinds besides these mentioned worthy of a place in every collection. Open soil, plenty of water and moderate shade.
,, leuconeurum ..	Mexico ..	
,, macrolobum ..	Garden hybrid ..	
,, regale	Peru ..	
,, Warocqueanum ..	Columbia ..	
,, Veitchii ..	Do. ..	
Asparagus plumosus ..	South Africa ..	Better known as the Asparagus Fern. A very elegant plant.
Begonia gogoensis	Sumatra ..	The cultivated forms of B. Rex are innumerable and no class of plant is more largely grown here.
,, Rex varieties ..	Garden hybrid ..	
Bertolonia marmorata ..	Brazil, ..	Very pretty leaved plants, but they require to be grown in a glass case to get the proper colouring.
,, Madam Pynaert ..	Garden hybrid ..	
Caladium, hybrids	South America ..	See special note on these.
Calathia makoyana	S. America ..	Better known under the old name of Marantas. Besides the five mentioned there are many others almost equally good. All require a good deal of shade.
,, massangeana ..	Brazil ..	
,, Sanderiana ..	T. America ..	
,, Veitchii	Do. ..	
,, zebrina	Brazil ..	

Cissus discolor	Java ..	Climber with handsome variegated leaves. Grow in shade.
Codiæum variegatum ..	South Sea Islands..	Crotons are too well known to need any remarks.
Curculigo recurvata ..	Malaya ..	C. recurvata has green leaves; and the variety variegata silvery grey leaves. It is less common than the former.
,, variegata ..	Do. ..	
Curmeria picturata ..	Columbia ..	Dwarf Aroids (now included in the germs Homalomnea) with prettily variegated leaves.
,, Wallisii	Do. ..	
Cyanophyllum magnificum ..	Mexico ..	Leaves 1—2 ft. long, velvety green with white veins. Requires shade.
Cycas circinalis	East Indies ..	Palm-like plants with dark green leathery leaves, suitable for growing in dry dusty places.
,, Rumphii	Malaya ..	
Cyrtosperma Johnstonii ..	Solomon Isles ..	Often known as Alocasia Johnstonii.
Dieffenbachia Bauseii ..	Garden hybrid ..	Tall growing Aroids with handsomely variegated leaves. Plenty of leaf mould and rather dense shade. The juice of all these is poisonous and care should be taken handling them.
,, Bowmanii ..	Brazil ..	
,, brasiliensis ..	Do. ..	
,, Chelsonii ..	Columbia ..	
,, regina ..	South America ..	
Dracæna Goldieana ..	West Africa ..	Leaves marbled with dark green and silvery grey.
,, Sanderiana ..	Do. ..	Beautifully variegated plant.
,, (Cordyline) terminalis	South Sea Islands	This is supposed to be the parent of the numerous varieties of Dracæna cultivated here.
Fittonia Verschaffelti ..	Peru ..	Dwarf plant with prettily variegated leaves, specially adapted for rock-work shade.
,, argyroneura ..	Do. ..	
,, Pearcei	Do. ..	
Heliconia rubra	South America ..	Large, quick growing, highly ornamented foliage plants. Moderate shade and plenty of water.
,, aureo-striata ..	Do. ..	
,, metallica	Do. ..	

A SELECT LIST OF EASILY GROWN PLANTS SUITABLE FOR CULTIVATION IN POTS AND BASKETS—*Continued.*

Name.	Native Country.	Remarks.
Kæmpferia Gilbertii ..	Burma ..	Plants belonging to the Ginger family; suitable for rock work.
,, Parishii ..	Langkawi ..	
Leea amabilis	Borneo ..	A shrub; leaflets deep bronzy green with a white stripe down the centre. A very handsome plant. Shade.
Nepenthes albo-marginata ..	Penang ..	Pitcher plants. There are many others equally good and all are best adapted for hanging baskets. The pitcher is only a portion of the leaf.
,, phyllamphora ..	Do. ..	
,, Rafflesiana ..	Singapore ..	
,, sanguinea ..	Perak ..	
Nephthytis picturata ..	Congo ..	Aroid with variegated leaves.
Panax elegans	Queensland ..	Panax and Aralias are very nearly allied They are useful for growing in sunny places.
,, laciniatum	South Sea Islands ..	
Pandanus Veitchii	Java ..	Leaves bordered with broad bands of pure white.
Paullinia thalictrifolia ..	South America ..	Climber.
Peperomia marmorata ..	Brazil ..	Dwarf ornamental leaved plants, somewhat like Begonia, and requiring same treatment.
,, Saundersii ..	Do. ..	
Philodendron gloriosum ..	Columbia ..	Fine leaved plants in the way of Anthuriums, but generally climbing. Shade, moisture and an open soil.
,, Mamei ..	Ecuador ..	
,, Selloum ..	Brazil ..	
,, speciosum ..	Do. ..	
,, verrucosum ..	Ecuador ..	
Phrynium variegatum ..	Singapore ..	A variety of the Arrow-root, Maranta Arundinacea, beautifully variegated plants.

Phyllanthus nivosus ..	South Sea Islands	Pretty dwarf shrub. Sun.
Phyliotænium Lindenii ..	New Grenada ..	Ornamental Aroid. Shade.
Piper porphorphyllum ..	Malaya ..	Climbing Peppers with variegated leaves; both require shade.
,, rubro-venosa ..	Moluccas ..	
Pothos aurea	Solomon Isles ..	Strong growing plant suitable for a pillar or tree stump.
Schismatoglottis crispata ..	Borneo, ..	Dwarf Aroids with ornamental leaves; grow in shade.
,, longispatha ..	Do. ..	
Strobilanthes Dyerianus ..	Burma ..	Beautifully variegated leaves and a rapid grower.

C.—FERNS.

Adiantum æthiopicum ..	Africa ..	The genus Adiantum includes all the kinds commonly known as Maidenhair Ferns. All of them are beautiful for arranging with other plants in rooms, &c., and most of them for cutting to mix with flowers for table decoration, &c.
,, Bauseii	Garden variety ..	
,, colpodes ..	Peru ..	
,, concinnum ..	South America ..	
,, Flemingii ..	Garden variety ..	
,, Collisii	Do. ..	
,, cuneatum ..	Brazil ..	
,, Lawsonianum .	Garden variety ..	
,, curvatum ..	South America ..	
,, cyclosorum ..	Ecuador ..	
,, decorum ..	Peru ..	
,, Farleyense ..	Barbadoes ..	A few kinds are found in most gardens, the most common being A. colpodes, A. tenerum and A. trapeziforme.
,, Fergusonii ..	Ceylon ..	
,, formosum ..	Australia ..	
,, gracillimum ..	Garden variety ..	
,, Lathomi ..	Do. ..	

A SELECT LIST OF EASILY GROWN PLANTS SUITABLE FOR CULTIVATION IN POTS AND BASKETS—*Continued.*

Name.	Native Country.	Remarks.
Adiantum macrophyllum ..	South America ..	
,, bipinnatum ..	Do. ..	
,, Pacotii	Garden variety ..	A. cuneatium is known locally as the English Maidenhair (but it is not the true British Maidenhair) and A. formosum as the Australian Fern.
,, peruvianum ..	Peru ..	
,, polyphyllum ..	Columbia ..	
,, Seemanii ..	C. America ..	
,, tenerum	Mexico ..	
,, tetraphyllum ..	T. America ..	
,, trapeziforme ..	West Indies ..	
,, Veitchianum ..	Peru ..	Light soil, plenty of water when growing freely. Protection from very heavy rain, and a light airy but not too sunny a position are the principal requirements for successful cultivation.
Aspidium triangulum .	West Indies ..	
Asplenium Belangerii ..	Malay Peninsula ..	
,, cicutarium ..	T. America ..	
,, laserpitiifolium .	Malaya ..	
,, longissimum ..	Penang, &c. ..	Very useful for hanging baskets.
,, macrophyllum ..	Do. ..	
,, nidus ..	Do. ..	Bird's-nest Fern.
Blechnum brasiliense ..	Brazil ..	Large bold Fern requiring shade and moisture.
Brainea insignis	Pulau Sembilan ..	Small growing tree Fern not known to occur in this region until recently; grows well.
Cyathea spinulosa	Penang ..	Large tree Fern; at low elevations.
Davallia affinis	Ceylon ..	
,, elegans	Tropics ..	These do well for hanging baskets.
,, fijiensis	Fiji ..	

Davallia pallida	Borneo ..	Better known as D. Mooreanus or the Sarawak Fern.
,, tenuifolia Veitchiana ..	Penang ..	Locally known as the Lace Fern.
Dicksonia Barometz ..	Do. ..	Handsome tree Fern.
Gymnogramme calomelanos ..	Tropics ..	Gold and silver Ferns, of which there are a great number of cultivated garden varieties, some of them beautifully crested. A dry airy situation with protection from heavy rain is necessary.
,, chrysophylla ..	Do. ..	
,, peruvianum ..	Peru ..	
,, schizophylla ..	Jamaica ..	
Lygodium dichotomum ..	Malaya ..	Climbing Ferns not often seen in gardens, but deserving of a place.
,, polystachyum ..	Do.	
Nephrolepis pluma	Madagascar ..	Large easily grown plant, useful for decorating rooms, &c.
,, rufescens tripinnatifida	Garden variety ..	
,, davallioides furcans ..	Do. ..	
Onychium auratum ..	Perak ..	A very handsome gold Fern found in the neighbourhood of Kuala Kangsa, Perak.
Platycerium æthiopicum ..	Guinea Coast ..	Stag's-horn Ferns. These succeed best fastened to a block of wood or the stump of a tree, but they can also be grown in hanging baskets if desired. Moderate shade.
,, biforme ..	Penang ..	
,, grande ..	Langkawi ..	
,, Hillii	Queensland ..	
Pteris argyrea	Malaya ..	A beautifully variegated form of P. quadriaurita.
,, cretica var. albo-lineata ..	Tropics ..	Useful decorative plants, requiring moderate shade.
,, palmata	T. America ..	
,, semi-pinnata	India ..	
D.—Palms.		
Borassus flabelliformis ..	India ..	The Lontar.

A SELECT LIST OF EASILY GROWN PLANTS SUITABLE FOR CULTIVATION IN POTS AND BASKETS—*Continued.*

Name.	Native Country.	Remarks.
Calamus sps.	Malaya ..	"Rotan" suitable when young for pots.
Caryota mitis	Penang, &c. ..	These all grow to a considerable size but, as in the case of most other palms, can be kept in pots or tubs for years if watering is not neglected.
„ sobolifera	Malacca ..	
„ urens	India ..	
Chrysalidocarpus lutescens ..	Madagascar ..	A beautiful palm better known as Areca lutescens which is the old name.
Cocos plumosa	Brazil ..	Two very handsome palms. C. Weddeliana is somewhat slow growing and delicate.
„ Weddeliana	S. America ..	
Cyrtostachys lacca	Malaya ..	Red-stemmed palms, "Pinang Rajah" of Malays.
„ Rendah ..	Do. ..	
Diplothemium maritimum ..	Brazil ..	Distinct dwarf species.
Elæis guineensis	Guinea ..	Oil palm. Nice pot plant while young.
Geonoma gracilis	Brazil ..	Small growing graceful plant.
Hedyscepe canterburyana ..	Lord Howes Island	Leaves pinnate and thick.
Heterospathe elata	Moluccas	Elegant plant.
Howea Belmoriana	Lord Howes Island	Largely grown for decorative purposes in England.
Hyophorbe amaricaulis ..	Mauritius.	
Latania Commersonii ..	Do.	
Licuala acutifida	Penang ..	"Pinang Lawyer." Very slow.
„ grandis	Borneo ..	One of the handsome fan palms known.

Livistona altissima	Java.	
„ australis	E. Australia ..	Very ornamental palms with fan-shaped leaves, specially adopted for the decoration of rooms.
„ chinensis .. .	S. China ..	
„ Hoogendorpii ..	Java.	
„ olivæformis ..	Do.	
Martinezia caryotæfolia .	New Grenada ..	Underside of leaves covered with long black spines.
Maxmiliana Martiana ..	S. America ..	Good for pots when young.
Oncosperma tigillaria ..	Malaya ..	"Nibong" of Malays.
Oreodoxa oleracea	W. Indies ..	Cabbage Palm.
„ regia	Cuba.	
Phœnix rupicola	India ..	One of the prettiest of the Date Palms.
Pinanga maculata	Malaya ..	Local species worth collecting and growing.
„ malaiana ..	Penang, &c. ..	
Pritchardia pacifica ..	Pacific Islands ..	Requires plenty of shade.
Ptychosperma MacArthurii ..	New Guinea ..	Very free growing kind.
Rhaphis flabelliformis ..	S. China ..	Pretty dwarf kind.
Rhopalostylis Baueri ..	Norfolk Island ..	Also known as Areca.
„ sapida	N. Zealand ..	
Sabal Adamsonii	North America ..	Dwarf Fan Palm.
„ Blackburniana ..	Bermudas ..	Fan or Thatch Palm.
Stevensonia grandifolia ..	Seychelles ..	Leaves large, very handsome.
Thrinax radiata	Trinidad ..	Very pretty plant.
Verschaffeltia splendida ..	Seychelles ..	Handsome large leaf kind.

A Select List of easily grown Plants suitable for cultivation in pots and baskets—*Continued.*

Name.	Native Country.	Remarks.
Wallichia caryotoides ..	India ..	Dwarf growing species.
,, disticha ..	Do. ..	Tall, habit resembling that of the Traveller's Palm.
F.—Orchids.		
Ærides affine	India ..	Flowers delicate rose.
,, crispum	Do. ..	Flowers white suffused with purplish rose.
,, Fieldingii	Assam ..	The Fox-brush Ærides.
,, Lobbii	Burma ..	Flower white in the centre, tinted with rose outside.
,, odoratum	India ..	Flowers creamy white.
,, quinquevulnerum ..	Philippines ..	Flowers white, with reddish crimson blotches.
,, suavissimum ..	Malaya ..	Fowers white, tipped with deep lilac.
,, virens	Do. ..	Flowers white, tipped with rosy purple.
Angrecum ebu-neum ..	Madagascar ..	Flowers white. These grow well in Penang.
,, Sanderianum ..	Do. ..	
,, sesquipedale ..	Do. ..	
Arachnanthe Lowii ..	Borneo ..	Better known as Vanda Lowii.
,, moschifera ..	Java ..	Requires to be grown in full sun.
Bulbophyllum Beccarii ..	Borneo.	
Calanthe Regnieri	Siam ..	These generally flower about November, December. After flowering they should be kept dry for two or three months and be reported as soon as they show signs of making new growths.
,, rosea	Burma ..	
,, rubens	Langkawi ..	
,, Veitchii	Garden hybrid ..	
,, vestita	Mergui, &c. ..	
Cirrhopetalum Medusæ ..	Malaya ..	Flowers straw-coloured in dense heads. Very curious.

Cœlogyne asperata ..	Perak, Borneo ..	A free growing species with large cream coloured flowers.
,, pandurata ..	Do. ..	Flowers green and black, curious and distinct.
,, Parishii ..	Burma ..	Flowers brown and yellow.
Cypripedium Lowii ..	Borneo ..	Slipper Orchids, ''Bunga Kasut'' of Malays. There are a great number of species suitable for cultivation here.
,, niveum ..	Langkawi ..	
,, Stonii ..	Borneo ..	
Dendrobium aggregatum ..	Burma ..	Flowers yellow ; a small plant.
,, Dearii ..	Philippines ..	Flowers white ; very durable.
,, albo-sanguineum ..	Burma ..	Flowers white and crimson.
,, bigibbum ..	Do. ..	Flowers rosy-pink much like D. phalænopsis.
,, chrysotoxum ..	Do. ..	Pseudo-bulbs thick raceme 6—12 inches long. Flowers yellow.
,, cretaceum ..	Do. ..	Flowers chalky white.
,, crystallinum ..	Do. ..	Flowers white, tipped with rose or purple and lasting a long time.
,, Dalhousianum ..	Do. ..	Flowers buff with two large blotches of dark crimson on the lip. Free grower and certain to flower.
,, densiflorum ..	Do. ..	Flowers orange colour.
,, Farmerii ..	Do. ..	Flowers in pendulous racemes as in D. chrysotoxum and D. densiflorum, straw coloured, tinged with pink.
,, fimbriatum ..	Do. ..	Flowers orange, the lip bordered with a moss like [fringe.
,, formosum ..	Do. ..	Flowers large white with an orange throat.
,, macrophyllum ..	Java ..	Flowers greenish yellow. Also known as D. Veitchii.
,, moschatum ..	Burma ..	Creamy white flowers tinged with rose. A good grower.
,, Pierardii	Do. ..	Pseudo-bulbs pendulous. Grow in basket or on a block of wood.

A SELECT LIST OF EASILY GROWN PLANTS SUITABLE FOR CULTIVATION IN POTS AND BASKETS—*Concluded.*

Name.	Native Country.	Remarks.
Dendrobium phalænopsis ..	Solomon Isles ..	Very beautiful flowers in the way of D. bigibbum but larger.
,, suavissimum ..	Burma ..	Pseudo-bulbs similar to D. chrysotoxum. Flowers yellow with blotch of brownish purple on lip.
,, superviens ..	N. Australia ..	Flowers light purple or claret.
,, superbum ..	Philippines ..	Flowers pink tinged rose 3—4 inches across. Grow on a block.
,, thyrsiflorum ..	Burma ..	Flowers in large pendulous racemes. A good grower.
,, tortile ..	Mergui ..	Pale almost white flowers suffused with rose.
Grammatophyllum speciosum ..	Malaya ..	A large growing species and require to be grown in full sun.
,, multiflorum	Moluccas ..	Flowers green, brown and purple. Grow in a pot with peat and moss.
Habenaria carnea ..	Langkawi ..	Both these require resting, in the same way as Calanthos. When growing H. Susannæ requires full sun and plenty of water. The flowers of H. carnea last from six to seven weeks.
,, Susannæ ..	China, Timor ..	
Lycaste aromatica ..	Mexico.	
Oncidium ampliatum ..	C. America ..	All the Oncidiums are New World plants and the predominating colour is yellow. The four included in this list have done the best of the dozen or so species introduced and are much admired.
,, hæmatochilum ..	N. Grenada ..	
,, lanceanum ..	Demerara ..	
,, papilio	Trinidad ..	
Peristeria elata	Panama ..	Dove or Holy Ghost Flower; grows very easily in a pot.

Phajus albus	Burma ..	These two are commonly known as Thunias. They require to be rested after flowering and watering recommenced when the growths start.
,, Bensonii	Do. ..	
,, grandifolius	China, &c.	
Phalænopsis amabilis ..	Philippines ..	Phalænopsis being indigenous to this region it would seem reasonable to suppose that there is no difficulty in growing them, but that is not exactly the case. In some spots they do well, while in others only a short distance removed they fail entirely for no apparent reason.
,, esmeralda ..	Siam ..	
,, grandiflora ..	Borneo, Java ..	
,, Schilleriana ..	Philippines ..	
,, sumatrana ..	Sumatra, Perak ..	
,, violacea ..	Do. ..	
Platyclinis filiformis ..	Philippines.	
,, glumacea ..	Do. ..	Flowers white, sweet scented.
Renanthera coccinea ..	China ..	These require to be grown on a hardwood post or tree in the full blazing sun. It is useless trying to flower them in a shady place.
,, alba ..	Singapore ..	
,, matutina ..	Borneo ..	
Saccolabium Blumei ..	Malaya ..	May be all grown in pots, hanging baskets, or on blocks of wood in only moderate shade. All are pretty.
,, curvifolium ..	Burma, &c. ..	
,, Hendersonianum ..	Borneo ..	
,, giganteum ..	Burma ..	
Trichoglottis fasciata ..	Langkawi ..	Free flowering species.
Vanda insignis	Moluccas ..	There are many other Vandas that do well here, but these are the best. V. suavis and V. tricolor require rather more shade and water than the other two.
,, Sanderiana	Philippines ..	
,, suavis	Java ..	
,, tricolor	Do. ..	